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12/08/99 JC900 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 2204/186
Total Pages in this Submission 27

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SYSTEM, DEVICE, AND METHOD FOR SENDING KEEP-ALIVE MESSAGES IN A COMMUNICATION NETWORK

and invented by:

Bradley Cain

jc584 U.S. PTO 09/457209 12/08/99

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☐ Filing fee as calculated and transmitted as described below
2. ☒ Specification having 15 pages and including the following:
   - a. ☒ Descriptive Title of the Invention
   - b. ☐ Cross References to Related Applications *(if applicable)*
   - c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   - d. ☐ Reference to Microfiche Appendix *(if applicable)*
   - e. ☒ Background of the Invention
   - f. ☒ Brief Summary of the Invention
   - g. ☒ Brief Description of the Drawings *(if drawings filed)*
   - h. ☒ Detailed Description
   - i. ☒ Claim(s) as Classified Below
   - j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
2204/186

Total Pages in this Submission
27

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   - a. ☐ Formal Number of Sheets _____
   - b. ☒ Informal Number of Sheets 4

4. ☒ Oath or Declaration
   - a. ☐ Newly executed *(original or copy)* ☒ Unexecuted
   - b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   - c. ☒ With Power of Attorney ☐ Without Power of Attorney
   - d. ☐ *DELETION OF INVENTOR(S)*
     Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
   The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   - a. ☐ Paper Copy
   - b. ☐ Computer Readable Copy *(identical to computer copy)*
   - c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☐ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☐ Information Disclosure Statement/PTO-1449 ☐ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing
    ☐ First Class ☒ Express Mail *(Specify Label No.):* EL442683417US

UTILITY PATENT APPLICATION TRANSMITTAL
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2204/186

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27

Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☐ Additional Enclosures *(please identify below):*

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	24	- 20 =	4	x	$18.00	$72.00
Indep. Claims	4	- 3 =	1	x	$78.00	$78.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$760.00
OTHER FEE *(specify purpose)* _____						$0.00
					TOTAL FILING FEE	$910.00

☐ A check in the amount of to cover the filing fee is enclosed.

☐ The Commissioner is hereby authorized to charge and credit Deposit Account No. as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☐ Credit any overpayment.
- ☐ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Jeffrey T. Klayman
Signature

Dated: **December 8, 1999**

Jeffrey T. Klayman, Reg. No. 39,250
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cc:

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): **Cain**			Docket No. **2204/186**
Serial No. **Not Yet Assigned**	Filing Date **Herewith**	Examiner **Not Yet Assigned**	Group Art Unit **Not Yet Assigned**

Invention: **SYSTEM, DEVICE, AND METHOD FOR SENDING KEEP-ALIVE MESSAGES IN A COMMUNICATION NETWORK**

I hereby certify that this **Utility Patent Application Transmittal and enclosures referred to therein**
(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Assistant Commissioner for Patents, Washington, D.C. 20231 on

December 8, 1999
(Date)

Jeffrey T. Klayman
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(Signature of Person Mailing Correspondence)

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION FOR UNITED STATES PATENT

FOR

SYSTEM, DEVICE, AND METHOD FOR SENDING KEEP-ALIVE MESSAGES IN A COMMUNICATION NETWORK

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SYSTEM, DEVICE, AND METHOD FOR SENDING KEEP-ALIVE MESSAGES IN A COMMUNICATION NETWORK

FIELD OF THE INVENTION

The present invention relates generally to communication systems, and more particularly to sending keep-alive messages in a communication system.

BACKGROUND OF THE INVENTION

In today's information age, computers and computer peripherals are often internetworked over a communication network. The communication network includes a number of network nodes that interoperate to route protocol messages within the communication network. These network nodes typically run various routing protocols in order to determine forwarding paths for routing protocol messages within the communication network.

When a network node fails, the other network nodes need to route the protocol messages around the failed network node. The network nodes typically rely on "keep-alive" messages to determine whether a particular network node is operational. Each node periodically sends keep-alive messages to its neighbors. A network node may consider a particular neighbor to be operational as long as the neighbor is sending keep-alive messages.

Therefore, each network node receives keep-alive messages from its neighbors. The processing of keep-alive messages can be computationally intensive, especially if the network node has many neighbors.

SUMMARY OF THE INVENTION

In accordance with one aspect of the invention, the frequency for sending keep-alive messages to a neighbor is determined based upon a reliability factor for communicating with the neighbor. A node determines a reliability factor for

communicating with a neighbor and sets the frequency for sending keep-alive messages to the neighbor based upon the reliability factor. The reliability factor is determined based upon the reliability of the neighbor as well as the reliability of the communication link to the neighbor. The frequency for sending keep-alive messages to the neighbor is relatively high if the reliability factor is low. The frequency for sending keep-alive messages to the neighbor is relatively low if the reliability factor is high. The frequency for sending keep-alive messages to the neighbor is dynamically adjusted based upon an updated reliability factor.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other objects and advantages of the invention will be appreciated more fully from the following further description thereof with reference to the accompanying drawings wherein:

FIG. 1 is a logic flow diagram showing exemplary logic for determining a frequency for sending keep-alive messages to a neighbor in accordance with an embodiment of the invention;

FIG. 2 is a logic flow diagram showing exemplary logic for determining a reliability factor in accordance with an embodiment of the invention;

FIG. 3 is a logic flow diagram showing exemplary logic for adjusting the frequency for sending keep-alive messages to a neighbor in accordance with an embodiment of the invention; and

FIG. 4 is a logic flow diagram showing exemplary logic for adjusting frequency for sending keep-alive messages to a neighbor based upon an updated reliability factor in accordance with an embodiment of the invention.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

An exemplary embodiment of the present invention sets the frequency for sending keep-alive messages to a particular neighbor based upon a reliability factor for

communicating with the neighbor. The keep-alive messages are sent at a relatively low frequency if the reliability factor for communicating with the neighbor is high. This is because there is a relatively high likelihood that each keep-alive message will be received and processed by the neighbor, so fewer keep-alive messages are needed to keep the communication link to the neighbor active. The keep-alive messages are sent at a relatively high frequency if the reliability factor for communicating with the neighbor is low. This is because there is a relatively low likelihood that each keep-alive message will be received and processed by the neighbor, so more keep-alive messages are needed to keep the communication link to the neighbor active. The reliability factor is updated regularly, and the frequency for sending keep-alive message to the neighbor is dynamically adjusted accordingly.

Specifically, each node determines a reliability factor for communicating with each of its neighbors, and sets the frequency of keep-alive messages for each neighbor based upon the corresponding reliability factor. The reliability factor is preferably based upon the reliability of the neighbor as well as the reliability of the communication link to the neighbor, both of which can be determined to some degree and can vary over time. The node continually updates the reliability factor and adjusts the frequency of keep-alive messages accordingly.

More particularly, the node determines a reliability for the neighbor and a reliability for the communication link to the neighbor using predetermined reliability determination techniques. For example, the node may determine the reliability of the communication link to the neighbor by measuring communication link characteristics, such as signal-to-noise ratio, harmonic distortion, phase hits, gain hits, carrier-to-noise ratio, bit error rate, block error rate, packet error rate, cell loss ratio, congestion, or other characteristics. The node may determine the reliability for the neighbor based upon keep-alive or other messages received from the neighbor, including explicit status information provided by the neighbor. However, the present invention is in no way limited to any particular technique or techniques for determining the reliability of the neighbor and/or the reliability of the communication link to the neighbor.

Once the node determines the reliability for the neighbor and the reliability for the

communication link to the neighbor, the node determines the reliability factor based upon the reliability for the neighbor and the reliability for the communication link to the neighbor. In an exemplary embodiment of the invention, the node assigns a relative weight to each reliability determination. The reliability factor is the weighted average of the two reliability determinations. Thus the reliability factor RF can be represented by the following equation:

Eq. 1 $$RF = (W1*A + W2 * B)$$

where A is the reliability for the communication link to the neighbor, B is the reliability for the neighbor, W1 is the relative weight for A, and W2 is the relative weight for B.

The weights W1 and W2 are implementation-specific. In an exemplary weighting scheme, the weights W1 and W2 are initially set equal. The weights may be adjusted thereafter as network conditions change.

After determining the reliability factor RF for communicating with the neighbor, the node determines the frequency for sending keep-alive messages to the neighbor based upon the reliability factor RF. The frequency for sending keep-alive messages to the neighbor is inversely proportional to the reliability factor RF. Thus, the frequency for sending keep-alive messages to the neighbor is relatively low if the reliability factor RF is high, and the frequency for sending keep-alive messages to the neighbor is relatively high if the reliability factor RF is low.

FIG. 1 is a logic flow diagram showing exemplary logic 100 for determining a frequency for sending keep-alive messages to a neighbor. Beginning at step 102, the logic first determines a reliability factor for communicating with a neighbor, in step 104. The logic then determines a frequency for sending keep-alive messages to the neighbor based upon the reliability factor, in step 106. The logic 100 terminates in step 199.

FIG. 2 is a logic flow diagram showing exemplary logic 200 for determining the reliability factor. Beginning at step 202, the logic determines a reliability for the neighbor, in step 204, and also determines a reliability for the communication link to the neighbor, in step 206. The logic then assigns a relative weight to each of the reliability for the neighbor

and the reliability for the communication link to the neighbor, in step 208. The logic then determines the reliability factor to be the weighted average of the reliability for the neighbor and the reliability for the communication link to the neighbor, in step 210. The logic then sets the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor, in step 212. The logic 200 terminates in step 299.

FIG. 3 is a logic flow diagram showing exemplary logic 300 for adjusting the frequency for sending keep-alive messages to a neighbor. Beginning at step 302, the logic proceeds to determine an updated reliability factor, in step 304. The logic then adjusts the frequency for sending keep-alive messages to the neighbor based upon the updated reliability factor, in step 306. The logic 300 terminates in step 399.

FIG. 4 is a logic flow diagram showing exemplary logic 400 for adjusting frequency for sending keep-alive messages to a neighbor based upon an updated reliability factor. Beginning at step 402, the logic determines whether the updated reliability factor represents a reliability improvement or a reliability degradation, in step 404. The logic increases the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability degradation, in step 406. The logic decreases the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability improvement, in step 408. The logic 400 terminates in step 499.

In the described embodiments, the reliability factor is proportional to the reliability for communicating with the neighbor, and therefore the frequency for sending keep-alive messages to the neighbor is inversely proportional to the reliability factor. However, in an alternative embodiment of the invention, the reliability factor may be inversely proportional to the reliability for communicating with the neighbor (for example, the reliability factor may be an error measurement that increases as the reliability decreases), in which case the frequency for sending keep-alive messages to the neighbor is proportional to the reliability factor. The present invention is in no way limited by the technique for determining the reliability factor nor by the technique for deriving the frequency for sending keep-alive messages based upon the reliability factor.

In an exemplary embodiment of the present invention, predominantly all of the logic for sending keep-alive messages described herein is implemented as a set of

computer program instructions that are stored in a computer readable medium and executed by an embedded microprocessor system within a network node. Various embodiments of the invention may be implemented in any conventional computer programming language. For example, an embodiment may be implemented in a procedural programming language (*e.g.*, "C") or an object oriented programming language (*e.g.*, "C++"). Alternative embodiments of the invention may be implemented using discrete components, integrated circuitry, programmable logic used in conjunction with a programmable logic device such as a Field Programmable Gate Array (FPGA) or microprocessor, or any other means including any combination thereof.

Alternative embodiments of the invention may be implemented as a computer program product for use with a computer system. Such implementation may include a series of computer instructions fixed either on a tangible medium, such as a computer readable media (*e.g.*, a diskette, CD-ROM, ROM, or fixed disk), or fixed in a computer data signal embodied in a carrier wave that is transmittable to a computer system via a modem or other interface device, such as a communications adapter connected to a network over a medium. The medium may be either a tangible medium (*e.g.*, optical or analog communications lines) or a medium implemented with wireless techniques (*e.g.*, microwave, infrared or other transmission techniques). The series of computer instructions embodies all or part of the functionality previously described herein with respect to the system. Those skilled in the art should appreciate that such computer instructions can be written in a number of programming languages for use with many computer architectures or operating systems. Furthermore, such instructions may be stored in any memory device, such as semiconductor, magnetic, optical or other memory devices, and may be transmitted using any communications technology, such as optical, infrared, microwave, or other transmission technologies. It is expected that such a computer program product may be distributed as a removable medium with accompanying printed or electronic documentation (*e.g.*, shrink wrapped software), preloaded with a computer system (*e.g.*, on system ROM or fixed disk), or distributed from a server or electronic bulletin board over the network (*e.g.*, the Internet or World Wide Web).

The present invention may be embodied in other specific forms without departing

from the essence or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive.

I claim:

1. A method for sending keep-alive messages to by a node to a neighbor in a communication network, the method comprising:

determining a reliability factor for communicating with a neighbor; and

determining a frequency for sending keep-alive messages to the neighbor based upon the reliability factor.

2. The method of claim 1, wherein determining the reliability factor for communicating with the neighbor comprises:

determining a reliability for the neighbor; and

determining the reliability factor based upon the reliability for the neighbor.

3. The method of claim 1, wherein determining the reliability factor for communicating with the neighbor comprises:

determining a reliability for a communication link to the neighbor; and

determining the reliability factor based upon the reliability for the communication link to the neighbor.

4. The method of claim 1, wherein determining the reliability factor for communicating with the neighbor comprises:

determining a reliability for the neighbor;

determining a reliability for a communication link to the neighbor;

assigning a relative weight to each of the reliability for the neighbor and the reliability for the communication link to the neighbor;

determining the reliability factor to be a weighted average of the reliability for the neighbor and the reliability for the communication link to the neighbor.

5. The method of claim 1, wherein determining the frequency for sending keep-alive messages to the neighbor based upon the reliability factor comprises:

setting the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor.

6. The method of claim 1, further comprising:

updating the reliability factor; and

adjusting the frequency for sending keep-alive messages to the neighbor based upon the updated reliability factor.

7. The method of claim 6, wherein adjusting the frequency for sending keep-alive messages to the neighbor comprises:

reducing the frequency for sending keep-alive messages to the neighbor, if the updated reliability factor represents a reliability improvement for communicating with the neighbor; and

increasing the frequency for sending keep-alive messages to the neighbor, if the updated reliability factor represents a reliability degradation for communicating with the neighbor.

8. A device for sending keep-alive message to a neighbor in a communication network, the device comprising:

reliability determination logic operably coupled to determine a reliability factor for communicating with the neighbor; and

frequency determination logic responsive to the reliability determination logic and operably coupled to determine a frequency for sending keep-alive messages to the neighbor based upon the reliability factor.

9. The device of claim 8, wherein the reliability determination logic is operably coupled to determine a reliability for the neighbor and determine the reliability factor based upon the reliability for the neighbor.

10. The device of claim 8, wherein the reliability determination logic is operably coupled to determine a reliability for a communication link to the neighbor and determine the reliability factor based upon the reliability for the communication link to the neighbor.

11. The device of claim 8, wherein the reliability determination logic is operably coupled to determine a reliability for the neighbor, determine a reliability for a communication link to the neighbor, assign a relative weight to each of the reliability for the neighbor and the reliability for the communication link to the neighbor, and determine the reliability factor to be a weighted average of the reliability for the neighbor and the reliability for the communication link to the neighbor.

12. The device of claim 8, wherein the frequency determination logic is operably coupled to set the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor.

13. The device of claim 8, wherein the reliability determination logic is operably coupled to update the reliability factor, and wherein the frequency determination logic is operably coupled to adjust the frequency for sending keep-alive messages to the neighbor

based upon the updated reliability factor.

14. The device of claim 13, wherein the frequency determination logic is operably coupled to reduce the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability improvement for communicating with the neighbor and increase the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability degradation for communicating with the neighbor.

15. A program product comprising a computer readable medium having embodied therein a computer program for sending keep-alive messages to a neighbor in a communication network, the computer program comprising:

reliability determination logic programmed to determine a reliability factor for communicating with the neighbor; and

frequency determination logic responsive to the reliability determination logic and programmed to determine a frequency for sending keep-alive messages to the neighbor based upon the reliability factor.

16. The program product of claim 15, wherein the reliability determination logic is programmed to determine a reliability for the neighbor and determine the reliability factor based upon the reliability for the neighbor.

17. The program product of claim 15, wherein the reliability determination logic is programmed to determine a reliability for a communication link to the neighbor and determine the reliability factor based upon the reliability for the communication link to the neighbor.

18. The program product of claim 15, wherein the reliability determination logic is programmed to determine a reliability for the neighbor, determine a reliability for a communication link to the neighbor, assign a relative weight to each of the reliability for the neighbor and the reliability for the communication link to the neighbor, and determine the reliability factor to be a weighted average of the reliability for the neighbor and the reliability for the communication link to the neighbor.

19. The program product of claim 15, wherein the frequency determination logic is programmed to set the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor.

20. The program product of claim 15, wherein the reliability determination logic is

programmed to update the reliability factor, and wherein the frequency determination logic is programmed to adjust the frequency for sending keep-alive messages to the neighbor based upon the updated reliability factor.

21. The program product of claim 20, wherein the frequency determination logic is programmed to reduce the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability improvement for communicating with the neighbor and increase the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability degradation for communicating with the neighbor.

22. A communication system comprising a plurality of interconnected devices including a node and a neighbor in communication over a communication link, wherein the node is operably coupled to send keep-alive messages to the neighbor, and wherein the node is operably coupled to determine a frequency for sending keep-alive messages to the neighbor based upon a reliability factor for communicating with the neighbor over the communication link.

23. The communication system of claim 22, wherein the node is operably coupled to determine the reliability factor based upon a reliability for the neighbor and a reliability for the communication link.

24. The communication system of claim 22, wherein the node is operably coupled to set the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor.

ABSTRACT OF THE DISCLOSURE

A system, device, and method for sending keep-alive messages in a communication network involves determining a reliability factor for communicating with a neighbor and setting the frequency for sending keep-alive messages to the neighbor based upon the reliability factor. The reliability factor is determined based upon the reliability of the neighbor as well as the reliability of the communication link to the neighbor. The frequency for sending keep-alive messages to the neighbor is relatively high if the reliability factor is low. The frequency for sending keep-alive messages to the neighbor is relatively low if the reliability factor is high. The frequency for sending keep-alive messages to the neighbor is dynamically adjusted based upon an updated reliability factor.

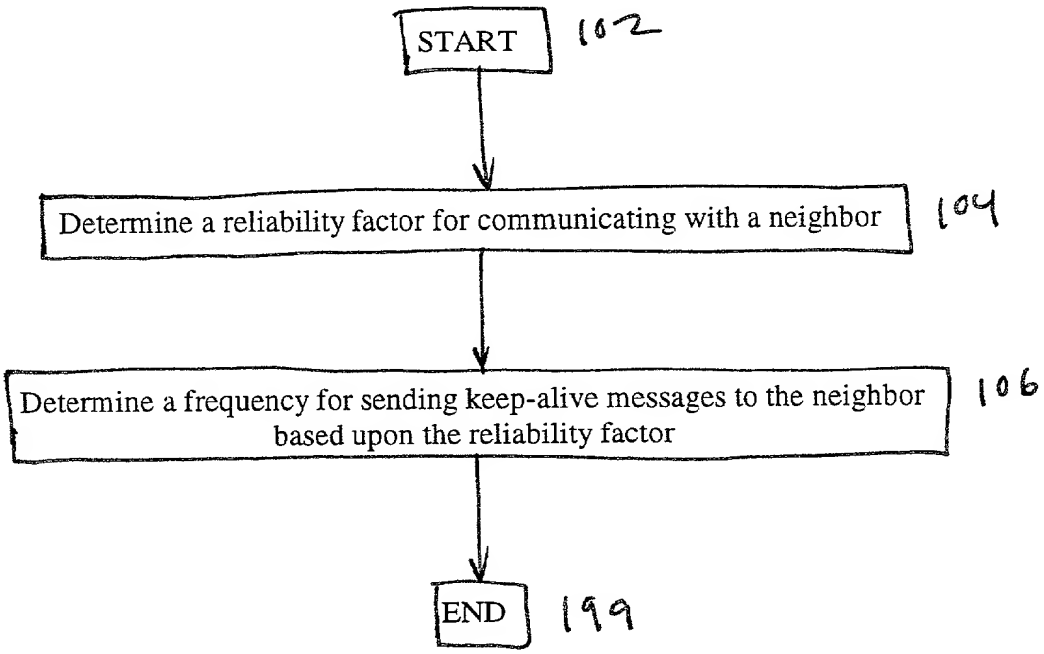
START
102
Determine a reliability factor for communicating with a neighbor
104
Determine a frequency for sending keep-alive messages to the neighbor based upon the reliability factor
106
END
199

FIG. 1 100

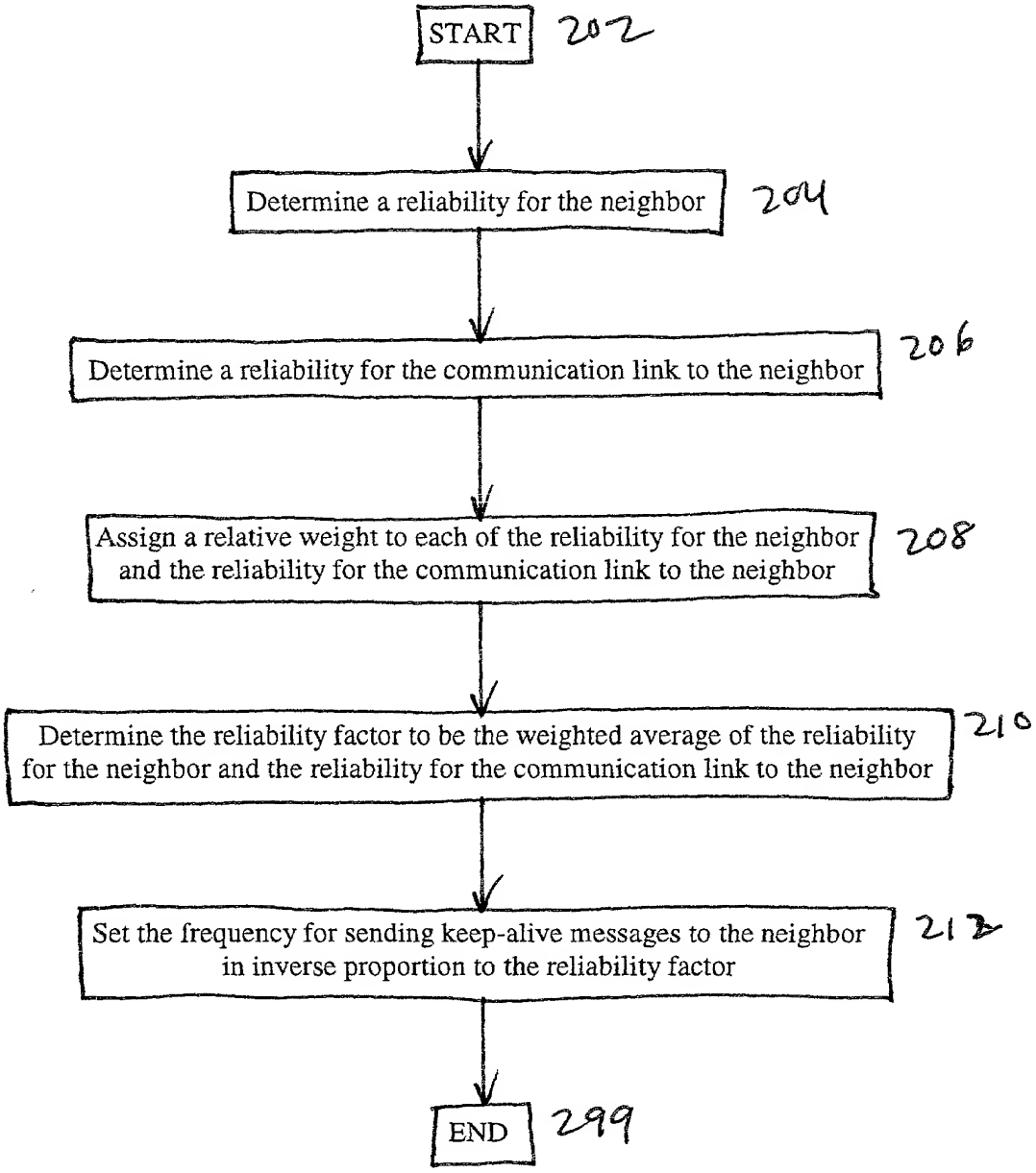
START
202
Determine a reliability for the neighbor
204
Determine a reliability for the communication link to the neighbor
206
Assign a relative weight to each of the reliability for the neighbor and the reliability for the communication link to the neighbor
208
Determine the reliability factor to be the weighted average of the reliability for the neighbor and the reliability for the communication link to the neighbor
210
Set the frequency for sending keep-alive messages to the neighbor in inverse proportion to the reliability factor
212
END
299

FIG. 2 200

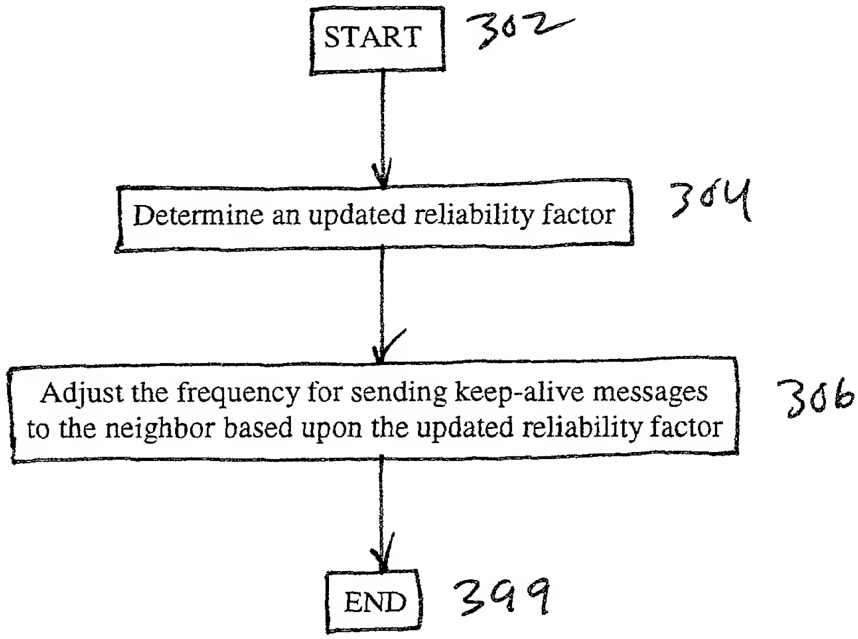
START
302
Determine an updated reliability factor
304
Adjust the frequency for sending keep-alive messages to the neighbor based upon the updated reliability factor
306
END
399

FIG. 3 300

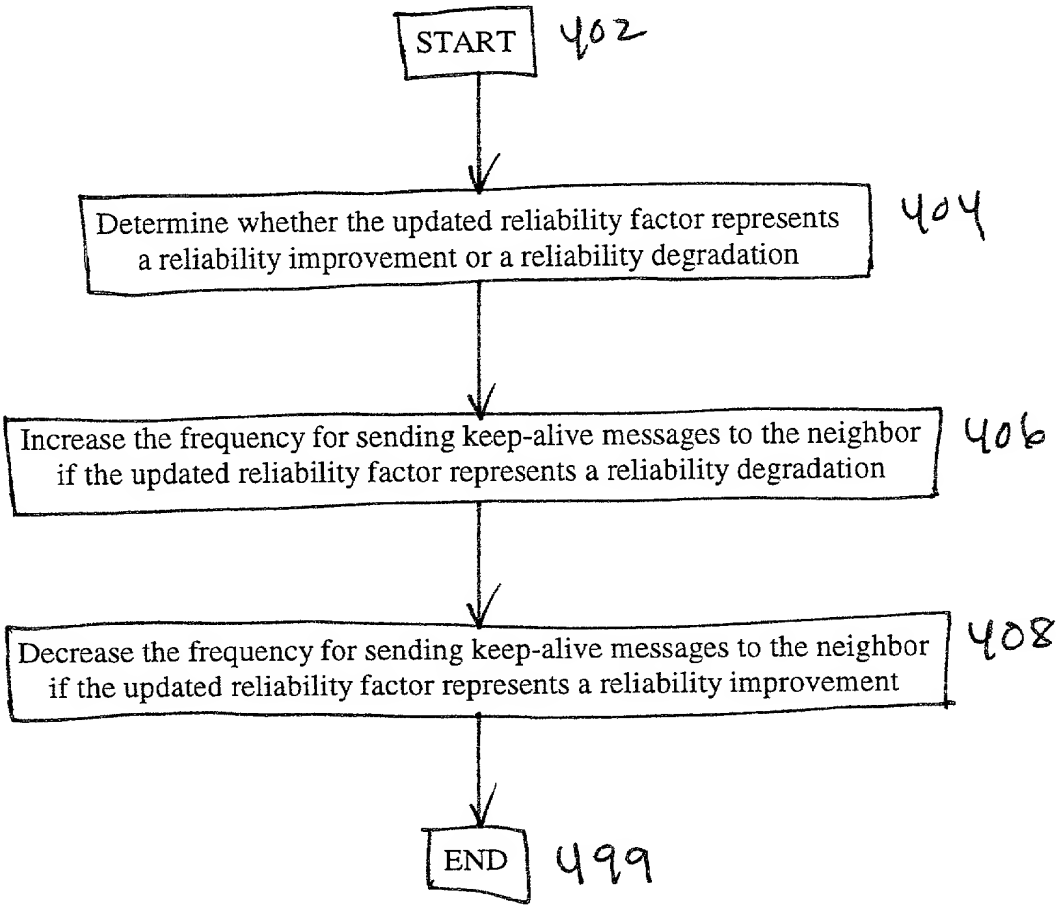
START
402
Determine whether the updated reliability factor represents a reliability improvement or a reliability degradation
404
Increase the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability degradation
406
Decrease the frequency for sending keep-alive messages to the neighbor if the updated reliability factor represents a reliability improvement
408
END
499

FIG. 4 400

Docket No.
2204/186

Declaration and Power of Attorney For Patent Application

English Language Declaration

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

SYSTEM, DEVICE, AND METHOD FOR SENDING KEEP-ALIVE MESSAGES IN A COMMUNICATION NETWORK

the specification of which

(check one)

☒ is attached hereto.

☐ was filed on _____ as United States Application No. or PCT International Application Number _____

and was amended on _____

(if applicable)

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365(b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application(s)			Priority Not Claimed
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐
_____ (Number)	_____ (Country)	_____ (Day/Month/Year Filed)	☐

I hereby claim the benefit under 35 U.S.C. Section 119(e) of any United States provisional application(s) listed below:

(Application Serial No.)	(Filing Date)

I hereby claim the benefit under 35 U. S. C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112, I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C. F. R., Section 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

(Application Serial No.)	(Filing Date)	(Status) (patented, pending, abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith. *(list name and registration number)*

Bruce D. Sunstein	**Reg. No. 27,234**	**Jay Sandvos**	**Reg. No. 43,900**
Robert M. Asher	**Reg. No. 30,445**	**Sonia K. Guterman**	**Reg. No. 44,729**
Timothy M. Murphy	**Reg. No. 33,198**	**Keith J. Wood**	**Reg. No. 45,235**
Steven G. Saunders	**Reg. No. 36,265**	**Mary M. Steubing**	**Reg. No. 37,946**
Harriet M. Strimpel	**Reg. No. 37,008**	**Christopher J. Cianciolo**	**Reg. No. 42,417**
Samuel J. Petuchowski	**Reg. No. 37,910**	**Lindsay J. McGuinness**	**Reg. No. 38,549**
Jeffrey T. Klayman	**Reg. No. 39,250**		
John J. Stickevers	**Reg. No. 39,387**		
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